



Onyx Technical Product Specification

Model

13500H / NUC13OXi5

13600H / NUC13OXv5

13700H / NUC13OXi7

13900H / NUC13OXv9
(Full Height Chassis)

13500H / NUC13OXXi5

13600H / NUC13OXXv5

13700H / NUC13OXXi7

13900H / NUC13OXXv9

(Slim Height Chassis)

Revision Date: 01/23/24

Version # 1.

Preface

The purpose of this document is to provide technical reference for customers and developers for the Onyx family of products. Onyx SKUs include NUC13OXv9, NUC13OXi7, NUC13OXv5, NUC13OXi5, NUC13OXKv9, NUC13OXKi7, NUC13OXKv5, and NUC13OXKi5.

Contents

Tables	4
Figures	5
1. Description	
The Onyx is a small form factor PC powered by an Intel 13th Generation series mobile processor. It is available in Full Height and Slim chassis versions. This is great for everyday use in office environments, lite CAD development and video editing, and mid tier gaming.	6
1.1. Overview	6
16.1. Processor	6
Table 1: CPU Features	6
16.2. Integrated Graphics Processing Unit	7
Table 2: Integrated Graphics	7
16.3. Memory / DDR5 SO-DIMM Socket	7
16.4. Storage	8
16.5. SATA Interface	8
16.6. PCIe Interface	8
16.7. Networking	9
16.7.1. RJ-45 Connector Networking Interface	9
16.7.2. Wireless Networking Interface	9
17. Technical Reference	10
17.1.1. Battery Header	10
Figure 1: Top Side Header Locations	10
Table 3: Top Side Header Definitions	10
17.2. COMs Header	10
Figure 2: COMs Header	10
Table 4: COMs Header Pinout	10
17.3. CPU Fan-Blower Header	11
Figure 3: CPU Fan - Blower Header	11
Table 5: CPU Fan-Blower Header Pinout	11
17.4. M.2 For Storage / nVME	12
Table 6: M.2 Key-M SSD Pinout	12
17.5. M.2 for Radio	14
Table 7: M.2 Key-E Pinout	14

17.6. SATA Header	16
Figure 4: SATA Header	16
Table 8: SATA Header Pinout	16
17.7. RGB Header Header	17
Table 9: RGB Pinout	17
17.8. Front Panel Header	17
Figure 6: Front Panel Header	17
Table 10: Front Panel Header Pinout	17
17.9. System / Motherboard	18
Figure 7: Top Down View In Chassis	18
17.10. Front & Back I/O Connectors	19
Figure 8: Front Side Connections	19
Table 11: Front Side I/O Connections Details	19
Front & Back I/O Connectors (continued)	20
Figure 9: Back Side I/O Connections	20
Table 12: Back Side I/O Connections Details	20
18. PCB Mechanical Dimensions	21
Figure 10: Top Side View of PCB	21
18.1. PCB - Motherboard Height	21
Figure 11: Motherboard Front Height	21
Figure 11: Motherboard Rear Height	21
18.2. System / Chassis Dimensions	22
Figure 13: System / Chassis Dimensions	22
Figure 12: Onyx “Slim Height” / Width / Length Dimensions	22
19. Version History	23

Tables

Table 1: CPU Features	6
Table 2: Integrated Graphics	6
Table 3: Top Side Header Definitions	8
Table 4: COM Header Pinout	8
Table 5: CPU Fan Header Pinout	9
Table 6: Bottom-Side Header Definitions	9
Table 7: M.2 Key-M SSD Pinout	10
Table 8: M.2 Key-E Pinout	11
Table 9: Front Panel Header Pinout	13
Table 10: Power LED System Status	14
Table 11: Front Side Connections Defined	14
Table 12: Back Side Connections Defined	15

Figures

Figure 1: Top Side Header Locations	8
Figure 2: COM Header	8
Figure 3: Bottom Side Header Locations	9
Figure 4: CMOS Header Settings	9
Figure 5: Front Panel Header	13
Figure 6: Front Side Connections	14
Figure 7: Back Side Connections	15
Figure 8: Motherboard Dimensions	15
Figure 9: Motherboard Height Dimensions	15

1. Description

The Onyx is a small form factor PC powered by an Intel 13th Generation series mobile processor. It is available in Full Height and Slim chassis versions. This is great for everyday use in office environments, lite CAD development and video editing, and mid tier gaming.

1.1. Overview

- 2. Available in Full height (53mm) chassis or Slim (37.7mm) chassis
- 3. Intel 13900H, 13800H, 13700H, 13600H, and 13500H
- 4. Intel 13th Generation (Raptor Lake)
- 5. Two JEDEC Standard DDR5- SO-DIMM Sockets
- 6. M.2 slot for PCIe Gen4
- 7. One 10/100/1000/2500Mbps Ethernet Port
- 8. M.2 slot for Wi-Fi / Bluetooth Radio
- 9. Two HDMI Ports (4k, 60Hz)
- 10. Two USB-C 3.2
- 11. One Front USB 2.0 Gen 2 Type-A Port
- 12. One Front USB 3.2 Gen 2 Type-A Port
- 13. Two Rear USB 3.2 Gen 2 Type-A Port
- 14. 3.5mm Combination Microphone/Headphone Jack
- 15. 120W Power Supply Adapter
- 16. 19V Input Power Supply Range

16.1. Processor

Table 1: CPU Features

Intel	13500H Raptor Lake	13600H Raptor Lake	13700H Raptor Lake	13900H Raptor Lake
P/N	i5-13500H	i5-13600H	i7-13700H	i9-13900H
Max Turbo Frequency	5.70GHz	4.80GHz	5.0GHz	5.40GHz
T junction	100°C	100°C	100°C	100°C
Cores	12	12	14	14
Threads	16	16	20	20
Performance Cores	4	4	6	6
Efficiency Cores	4	4	8	6
L3 Cache	16 MB	16 MB	24 MB	24 MB
TDP [W]	45 W	45 W	45 W	45 W
Integrated Graphics	Intel® Iris® Xe Graphics	Intel® Iris® Xe Graphics	Intel® Iris® Xe Graphics	Intel® Iris® Xe Graphics

16.2. Integrated Graphics Processing Unit

Table 2: Integrated Graphics

Intel Integrated	Intel® Iris® Xe Graphics
Graphics Max Dynamic Frequency	1.50 GHz
Graphics Output	eDP 1.4b, DP 1.4a, HDMI 2.1
Max Resolution (HDMI)	4096 x 2304 @ 60Hz
Max Resolution (DP)	7680 x 4320 @ 60Hz
Max Resolution (eDP - Integrated Flat Panel)	4096 x 2304 @ 120Hz
DirectX* Support	12.1
OpenGL* Support	4.6 / 3.0
Multi-Format Codec Engines	2
Intel® Quick Sync Video	Yes
Number Of Displays Supported	4

16.3. Memory / DDR5 SO-DIMM Socket

Onyx has two 262-pin 1.2V DDR5 SDRAM SODIMMS sockets:

- Support for DDR5 up to 5200
- Support for minimum 8GB single channel
- Support for maximum 64GB dual channel (32GB SO-DIMM per socket)

Processor / 13500H

- Up to DDR5 5200 MT/s
 - Maximum 2 Channel
 - 64 GB (Dependent upon memory type)
 - ECC not supported

Processor / 13600H

- Up to DDR5 5200 MT/s
 - Maximum 2 Channel
 - 64 GB (Dependent upon memory type)
 - ECC not supported

Processor / 13700H

- Up to DDR5 5200 MT/s
 - Maximum 2 Channel
 - 64 GB (Dependent upon memory type)
 - ECC not supported

Processor / 13900H

- Up to DDR5 5200 MT/s
 - Maximum 2 Channel
 - 64 GB (Dependent upon memory type)
 - ECC not supported

16.4. Storage

Onyx has a M.2 PCIe Gen3/4 connector supporting M.2 22x80 (key type M) for Nvme Only. One SATA 6.0 Gb/s combined data and power connector for 2.5 inch SSD

16.5. SATA Interface

The SATA III port has a theoretical maximum transfer rate of 8Gbps.

16.6. PCIe Interface

The M.2 slot is a key-M slot for an PCIe 2280 M.2 module, up to 8TB in density. The PCIe 4.0 x4 interface on the port has a theoretical maximum transfer rate of 8GBps.

16.7. Networking

Onyx has an Intel i226LM / 2.5 gigabit ethernet controller that interfaces to the onboard RJ-45 connector that provides up to 2.5 gigabit ethernet connection. The i226LM controller features:

- Integrated MAC + BASE-T PHY.
- MDI (Copper) standard IEEE 802.3 Ethernet interface for 2500BASE-T, 1000BASE-T, 100BASE-TX, and 10BASE-TE applications (802.3, 802.3u, 802.3bz, and 802.3ab).
- MDI lane swap.
- IEEE 802.3 auto-negotiator.
- IEEE 802.3x and IEEE 802.3z compliant flow control support with software-controllable Rx thresholds and Tx pause frames.
- Automatic crossover detection function (MDI/ MDI-X).
- IEEE 1588 protocol and 802.1AS implementation.
- Supporting Time Sensitive Networking (TSN) Capabilities (IEEE 802.1Qbu, 802.3br, 802.1Qbv, 802.1AS-REV, 802.1p, Q, and 802.1Qav).
- Supports IEEE 802.3az – Energy Efficient Ethernet (EEE).
- Smart Power Down (SPD) at S0 no link/Sx no link.
- Full wake up support (APM and ACPI).
- MAC Power Management controls.
- Power Management Protocol Offload (Proxying).
- Latency Tolerance Reporting (LTR.)
- TCP/UDP, Ipv4 checksum offloads (Rx/ Tx).
- Transmit Segmentation Offloading (TSO) (Ipv4, Ipv6).
- Legacy, Message Signal Interrupt (MSI) and Message Signal Interrupt Extension (MSI-X).
- Support for packets up to 9.5 KB (Jumbo Frames).
- Descriptor ring management hardware for Transmit and Receive.

16.7.1. RJ-45 Connector Networking Interface

The Onyx system has an RJ-45 connector which can run up to 2.5Gb speed. Refer to section 1.8 above for additional details.

16.7.2. Wireless Networking Interface

- 2.4Ghz, 5Ghz, and 6E support.
- Maximum bandwidth of 2.4Gbps
- 2x2 transmit/receive streams.
- Supports IEEE WLAN standards IEEE 802.11a/b/d/e/g/h/i/k/n/r/u/v/w/ac/ax
- Supports authentications WPA and WPA2, 802.1X EAP-TLS, EAP-TTLS/MSCHAPv2, PEAPv0-MSCHAPv2 (EAP-SIM, EAP-AKA, EAP-AKA')
- 64-bit and 128-bit WEP,TKIP, 128-bit AES-CCMP, 256-bit AES-GCMP encryption supported
- Bluetooth® 5.2, BLE.

17. Technical Reference

17.1.1. Battery Header

Figure 1: Top Side Header Locations

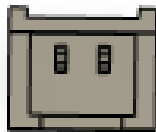


Table 3: Top Side Header Definitions

Pin	Signal
1	3V Positive (Right)
2	Ground

17.2. COMs Header

Figure 2: COMs Header



Table 4: COMs Header Pinout

Pin	Signal
1	DCD_1
2	RxD1
3	TxD1
4	DTR_1
5	GROUND
6	DSR_1

Pin	Signal
7	RTS_1
8	CTS_1
9	RI_1

Note: The COMs header outputs ``RS-232 TTL`` level signaling...

17.3. CPU Fan-Blower Header

Figure 3: CPU Fan - Blower Header

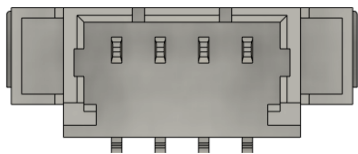


Table 5: CPU Fan-Blower Header Pinout

Pin	Signal Definition
1	5V
2	FAN_TAC2
3	FAN_CRL2
4	GROUND

17.4. M.2 For Storage / nVME

Table 6: M.2 Key-M SSD Pinout

Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	GND	73
70	3.3V	GND	71
68	N/A	PEDET	69
66	CONNECTOR KEY	N/A	67
64	CONNECTOR KEY	CONNECTOR KEY	65
62	CONNECTOR KEY	CONNECTOR KEY	63
60	CONNECTOR KEY	CONNECTOR KEY	61
58	N/A	CONNECTOR KEY	59
56	N/A	GND	57
54	WAKE#	PEFCLKp	55
52	CLKREQ#	PEFCLKn	53
50	PERST#	GND	51
48	N/A	PETp0	49
46	N/A	PETn0	47
44	N/A	GND	45
42	SMB_DATA	PERp0	43
40	SMB_CLK	PERn0	41
38	N/A	GND	39
36	N/A	PETp1	37
34	N/A	PETn1	35
32	N/A	GND	33

Pin	Signal	Signal	Pin
30	N/A	PERp1	31
28	N/A	PERn1	29
26	N/A	GND	27
24	N/A	PETp2	25
22	N/A	PETn2	23
20	N/A	GND	21
18	3.3V	PERp2	19
16	3.3V	PERn2	17
14	3.3V	GND	15
12	3.3V	PETp3	13
10		PETn3	11
8	N/A	GND	9
6	N/A	PERp3	7
4	3.3V	PERn3	5
2	3.3V	GND	3
		GND	1

17.5. M.2 for Radio

Table 7: M.2 Key-E Pinout

Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	GND	73
70	3.3V	GND	71
68	N/A	PEDET	69
66	CONNECTOR KEY	N/A	67
64	CONNECTOR KEY	CONNECTOR KEY	65
62	CONNECTOR KEY	CONNECTOR KEY	63
60	CONNECTOR KEY	CONNECTOR KEY	61
58	N/A	CONNECTOR KEY	59
56	N/A	GND	57
54	WAKE#	PEFCLKp	55
52	CLKREQ#	PEFCLKn	53
50	PERST#	GND	51
48	N/A	PETp0	49
46	N/A	PETn0	47
44	N/A	GND	45
42	SMB_DATA	PERp0	43
40	SMB_CLK	PERn0	41
38	N/A	GND	39
36	N/A	PETp1	37
34	N/A	PETn1	35
32	N/A	GND	33

Pin	Signal	Signal	Pin
30	N/A	PERp1	31
28	N/A	PERn1	29
26	N/A	GND	27
24	N/A	PETp2	25
22	N/A	PETn2	23
20	N/A	GND	21
18	3.3V	PERp2	19
16	3.3V	PERn2	17
14	3.3V	GND	15
12	3.3V	PETp3	13
10		PETn3	11
8	N/A	GND	9
6	N/A	PERp3	7
4	3.3V	PERn3	5
2	3.3V	GND	3
		GND	1

17.6. SATA Header

Figure 4: SATA Header

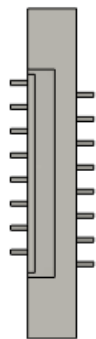


Table 8: SATA Header Pinout

Pin	Signal	Signal	Pin
1	5V	Ground	9
2	5V	Ground	10
3	5V	SATA_RX0P	11
4		SATA_RX0N	12
5		Ground	13
6		SATA_TX0P	14
7		SATA_TX0N	15
8	SATA_DEVSLP0	Ground	16

17.7. RGB Header Header

Figure 6: RGB Header



Table 9: RGB Pinout

Pin	Signal
1	12V Power (Left)
2	Red
3	Green
4	Blue (Right)

17.8. Front Panel Header

Figure 6: Front Panel Header

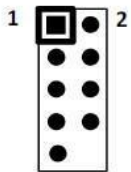


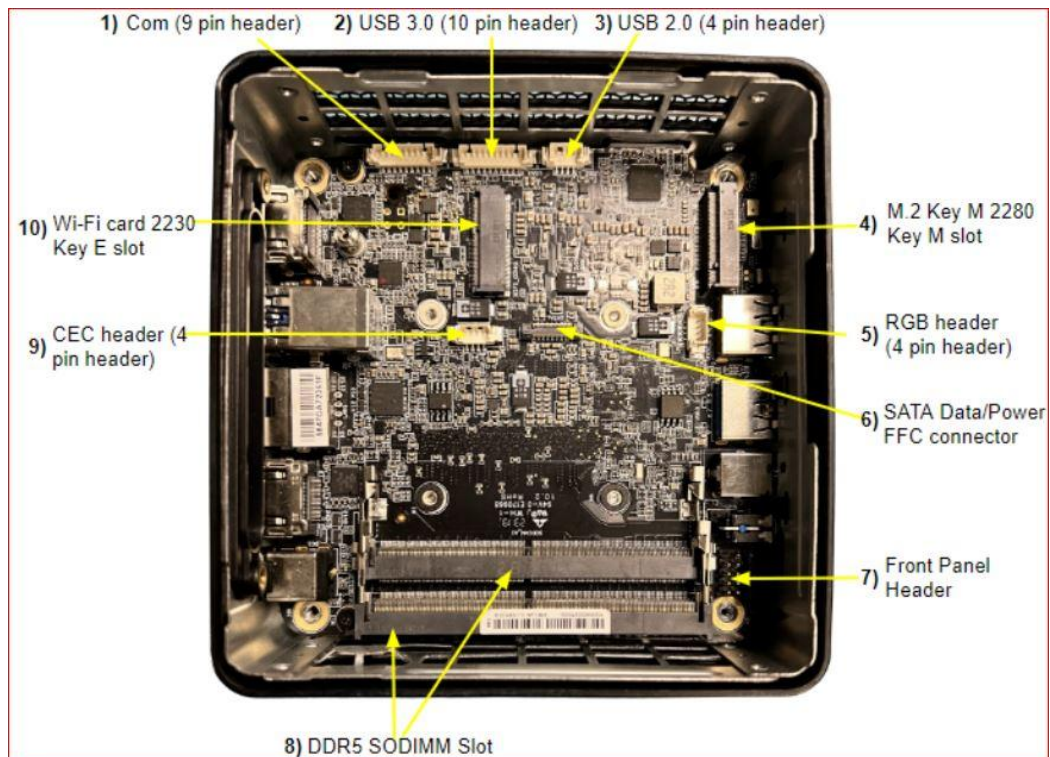
Table 10: Front Panel Header Pinout

Pin	Signal
1	HLED+
2	PWR_BTN_LED+
3	HLED-
4	PWR_BTN_LED-

Pin	Signal
5	GROUND/RESET
6	PANSHW
7	SYS_RST
8	GROUND
9	NOT USED
10	INTENTIONALLY BLANK

17.9. System / Motherboard

Figure 7: Top Down View In Chassis



17.10. Front & Back I/O Connectors

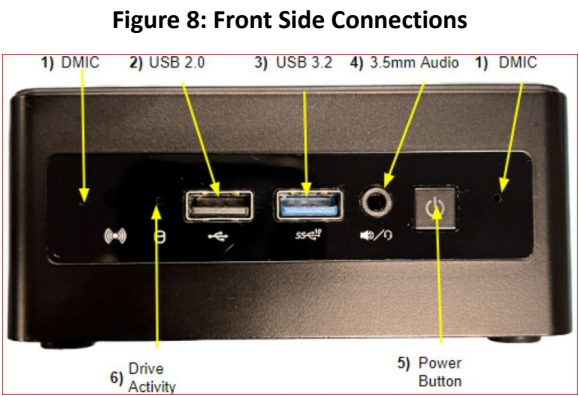


Table 11: Front Side I/O Connections Details

Identifier	Connector
1	Digital MIC
2	USB 2.0 Type A
3	USB 3.2 Type A
4	3.5mm Combination Jack
5	Power Button
6	Drive Activity LED

Front & Back I/O Connectors (continued)

Figure 9: Back Side I/O Connections

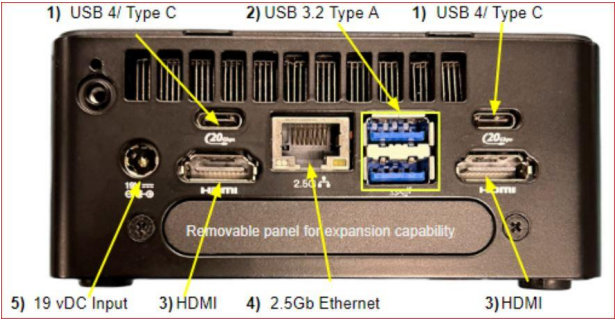
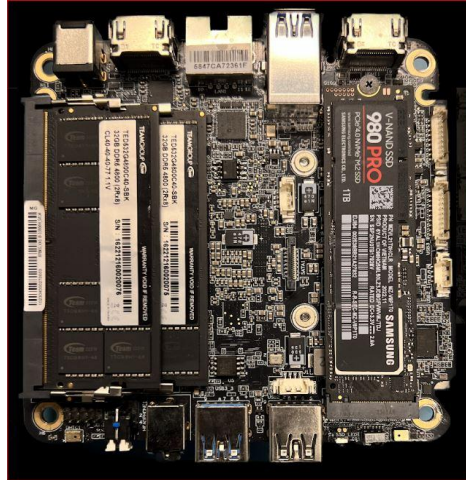


Table 12: Back Side I/O Connections Details

Identifier	Connector
1	USB 4 / Type C
2	USB 3.2 Type A / Stacked
3	HDMI
4	2.5Gb Ethernet / RJ-45
5	DC Input Voltage

18. PCB Mechanical Dimensions

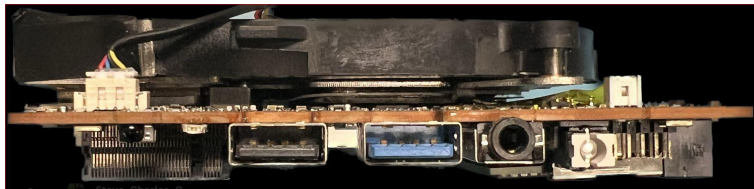
Figure 10: Top Side View of PCB



PCBWidth: 111.0mm PCB Length: 111.0mm
Board & Fan Assembly Height (Max): 27mm

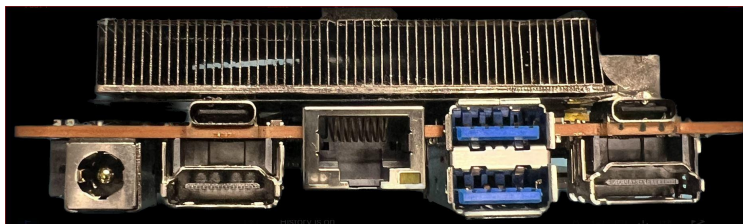
18.1. PCB - Motherboard Height

Figure 11: Motherboard Front Height



PCB 12.0mm / PCB & Fan-Blower 24mm

Figure 11: Motherboard Rear Height



PCB 15mm / PCB Fan-Blower 27mm

18.2. System / Chassis Dimensions

Figure 13: System / Chassis Dimensions



Figure 12: Onyx "Slim Height" / Width / Length Dimensions



19. Version History

Version	Date	Comments
0.1	09/05/13	Initial Draft for internal review.
1.0	09/06/23	Release Version
1.1	09/07/23	Minor updates to the Networking section, clarifying controller version, removal of the reference to a different system, and wordiong change to a figure label.
1.2	10/18/23	Formatting improvements for additional clarity Added clarification on operational status of CECE and COMMs header operating at TTL level.
1.3	1/23/2024	Formatting to include our Slim variants variants Technical clarifications to RAM capacity.